

Claims

[c1] A process for reducing ion content of washed cleavage product from the reaction of cumene hydroperoxide with an acid catalyst, comprising:

contacting the washed cleavage product with a cation exchanger to remove positively charged ions including sodium;

contacting the washed cleavage product with an anion exchanger to remove negatively charged ions including sulfate; and

recovering exchanger effluent lean in sodium and sulfate.

[c2] The process of claim 1 wherein the washed cleavage product comprises whole washed cleavage product.

[c3] The process of claim 1 wherein the washed cleavage product comprises dewatered cleavage product.

[c4] The process of claim 1 wherein the washed cleavage product comprises:

a molar ratio of acetone to phenol from 0.8 to 1.5;

from 2 to 30 weight percent cumene;

from 4 to 20 weight percent water; and

from 10 to 400 ppmw sodium.

- [c5] The process of claim 1, wherein the cation exchanger comprises strong acid cation exchange resin in hydrogen form.
- [c6] The process of claim 1, wherein the cation exchanger comprises weak acid cation exchange resin in hydrogen form.
- [c7] The process of claim 1, wherein the anion exchanger comprises weak base anion exchange resin in free base form.
- [c8] The process of claim 1, wherein the anion exchanger comprises strong base anion exchange resin in hydroxide form.
- [c9] The process of claim 1, wherein the anion and cation exchanger contacting comprises passing the washed cleavage product through a mixed bed of exchanger media comprising both cation and anion exchangers.
- [c10] The process of claim 9, wherein the effluent has a sodium concentration less than 10 ppmw.
- [c11] The process of claim 1, wherein the cation and anion exchangers comprise serial beds of cation and anion exchange resins, respectively.

- [c12] The process of claim 1, wherein the cation bed effluent has a sodium concentration less than 10 ppmw and a pH from 3.5 to 6.0.
- [c13] The process of claim 1, comprising a cation exchange adsorption cycle at a temperature from 20° to 80°C and a feed rate from 1 to 60 BV/h.
- [c14] The process of claim 13, comprising a cation exchange regeneration cycle with from 0.5 to 10 weight percent aqueous sulfuric acid.
- [c15] The process of claim 1, comprising an anion exchange adsorption cycle at a temperature from 20° to 80°C and a feed rate from 1 to 60 BV/h.
- [c16] The process of claim 15, comprising an anion exchange regeneration cycle with aqueous NaOH, sodium phenate, or a combination thereof, at NaOH or NaOH-equivalent concentration from 0.2 to 8 weight percent.
- [c17] A process for producing phenol, comprising:
oxidizing cumene to cumene hydroperoxide;
cleaving the cumene hydroperoxide in the presence of an acid catalyst to form a cleavage product mixture including phenol and acetone;
washing the cleavage product mixture with alkaline

wash solution to form a washed cleavage product; contacting the washed cleavage product with a cation exchanger and an anion exchanger to form a polished cleavage product of reduced ion content; and recovering phenol and acetone from the polished cleavage product.

- [c18] The process of claim 17, wherein the cation exchanger comprises cation ion exchange resins in hydrogen form selected from strong acid cation exchange resins and weak acid cation exchange resins, and the anion exchanger comprises anion exchanger resin selected from weak base anion exchange resins in free base form and strong base anion exchange resins in hydroxide form.
- [c19] The process of claim 17 wherein the polished cleavage product comprises less than 10 ppmw sodium.
- [c20] The process of claim 17, wherein the polished cleavage product comprises less than 2 ppmw sodium.
- [c21] The process of claim 17, wherein the washed cleavage product comprises a molar ratio of acetone to phenol from 0.8 to 1.5, from 2 to 30 weight percent cumene, from 4 to 20 weight percent water, and from 10 to 400 ppmw sodium.
- [c22] The process of claim 21, wherein the washing includes

coalescing a whole washed cleavage product to dewater the washed cleavage product for the exchanger contacting.

- [c23] The process of claim 21, wherein the product recovery includes distillation of the polished cleavage product and recovery of an aqueous stream, and the process further comprises recycling the aqueous stream to the washing step.
- [c24] The process of claim 21, further comprising dephenolating spent wash water from the washing.
- [c25] The process of claim 24, further comprising regenerating the cation and anion exchanger with aqueous and organic fluids, recycling spent aqueous fluid to the dephenolation, and recycling spent organic fluid to the cleavage product washing or the phenol and acetone recovery.